PATENTS
514453-3916

AMENDMENT

IN THE CLAIMS

Please enter the following amendments to the claims without prejudice, without admission, without surrender of subject matter, and without any intention of creating any estoppel as to equivalents as follows:

Claim 1 (currently amended)

1. A five-membered ring compound of the formula (I),

R^1-X-(A^1-M^1)$_a$-(A^2-M^2)$_b$-A^3-Y-E (I)

where the symbols and indices have the following meanings:

E is a radical T-Z-R^2 containing a five-membered ring, where:

(i) T is undirected and is
4-fluorothiophene-2,5-diyl, 3-fluorothiophene-2,5-diyl,
3-fluorothiophene-2,4-diyl or 5-fluorothiophene-2,4-diyl

Z is a single bond or -O-

R^2 is hydrogen or a straight-chain or branched alkyl radical (with or without asymmetric carbon atoms) having 1 to 20 carbon atoms, where one nonterminal CH_2 group may be replaced by -O- or -OC(=O)- or -C(=O)O- and/or one or more H atoms may be replaced by F, with the provisos that
a) the -CH_2- group nearest to the thiophene cannot be replaced by -O- when Z is -O-
b) R^2 can only be hydrogen when Z is a single bond,

Y is –OC (=O)- , -OCH_2-, -CH_2CH_2-

a, b are each, independently of one another, 0 or 1

(ii) T is furan-2,5-diyl or furan-2,4-diyl

Z is a single bond or -O-

R^2 is a straight-chain or branched alkyl radical (with or without asymmetric carbon atoms) having 1 to 20 carbon atoms, where one nonterminal CH_2

group nonadjacent to furan may be replaced by -O- or -OC(=O)- or -C(=O)O- and/or one or more H atoms may be replaced by F,

Y is -OC(=O)- , -OCH_2-, -CH_2CH_2-

a, b are each, independently of one another, 0 or 1

(iii) T is undirected and is isoxazole-3,5-diyl

Z is a single bond or -O-

R^2 is hydrogen or a straight-chain or branched alkyl radical (with or without asymmetric carbon atoms) having 1 to 20 carbon atoms, where one nonterminal CH_2 group may be replaced by -O- or -OC(=O)- or -C(=O)O- and/or one or more H atoms may be replaced by F, with the provisos that a) the -CH_2- group nearest to the isoxazole cannot be replaced by -O- when Z is -O-

b) R^2 can only be hydrogen when Z is a single bond,

a is 1

b is 0 or 1

Y is -OC(=O)- , -OCH_2-, -CH_2CH_2-

(iv) T is undirected and is thiazole-2,5-diyl or thiazole-2,4-diyl

Z is a single bond

R^2 is hydrogen or a straight-chain or branched alkyl radical (with or without asymmetric carbon atoms) having 1 to 20 carbon atoms, where one nonterminal CH_2 group may be replaced by -O- or -OC(=O)- or -C(=O)O- and/or one or more H atoms may be replaced by F,

Y is -OC(=O)- , -OCH_2-, -CH_2CH_2-

a, b are each, independently of one another, 0 or 1

~~(v) T is cyclopentane-1,3-diyl~~

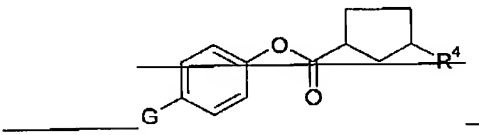
~~Z is a single bond or -O-~~

~~R^3 is hydrogen or a straight-chain or branched alkyl radical (with or without asymmetric carbon atoms) having 1 to 20 carbon atoms, where one nonterminal CH_2 group may be replaced by -O- or -OC(=O)- or -C(=O)O- and/or one or more H atoms may be replaced by F, with the provises that~~

~~a) the $-CH_2-$ group nearest to the cyclopentane cannot be replaced by -O- when Z is -O-~~

~~b) R^2 can only be hydrogen when Z is a single bond,~~

~~with the exception of compounds of the formula (II)~~



~~(II)~~

~~in which~~

~~R^4 is as defined for R^3~~

~~G is trans-4-propyl-cyclohexyl or trans-4-butyl-cyclohexyl or an alkyl group of 1 to 15 carbon atoms, in which, in addition, one or more nonadjacent CH_2 groups may be replaced by -O-, -CO-, -OCO-, -O-CO-O-, -CHhalogen-, -CHCN- and/or -CH=CH- or is F, CN,~~

(v)~~(vi)~~ **T** is cyclopentane-1,3-diyl, in which one $-CH_2CH_2-$ or $-CH_2CH-$ group is replaced by a -CH=CH- or. CH=C- group respectively

Z is a single bond

R^2 is hydrogen or a straight-chain or branched alkyl radical (with or without asymmetric carbon atoms) having 1 to 20 carbon atoms, where one nonterminal CH_2 group may be replaced by -O- or -OC(=O)- or -C(=O)O- and/or one or more H atoms may be replaced by F, with the proviso that the $-CH_2-$ group nearest to the cyclopentene cannot be replaced and where

Y cannot be $-CH_2-CH_2-$,

a is 1

b is 0 or 1

Y is -OC(=O)- , -OCH_2-

R^1 is hydrogen or a straight-chain or branched C_{1-20}-alkyl or C_{2-20}-alkenyl radical (with or without asymmetric carbon atoms), where

a) one or two nonterminal CH_2 groups may be replaced, independently of one another, by -O- or -C(=O)-, with the proviso that two adjacent CH_2 groups cannot be replaced in the same way, and/or

b) one CH_2 group may be replaced by -C≡C-, and/or

c) one CH_2 group may be replaced by -$Si(CH_3)_2$-, cyclopropane-1,2-diyl, cyclobutane-1,3-diyl, cyclopentane-1,4-diyl, bicyclo[1.1.1]pentane-1,3-diyl or cyclohexane-1,4-diyl, and/or

d) one or more H atoms may be replaced by F and/or CN,

e) in the case of a branched alkyl radical containing asymmetric carbon atoms, the asymmetric carbon atoms have -CH_3, -OCH_3, -CF_3, F, CN and/or Cl as substituents or are incorporated into a 3- to 7-membered ring, in which, in addition, one or two non-adjacent CH_2 groups may be replaced by -O- and one CH_2 group non-adjacent to these groups may be replaced by -OC(=O)-;

X is a single bond, -O-, OC(=O)-, -C(=O)O- or -OC(=O)O-

~~Y is -OC(=O)- , -OCH_2- , -CH_2CH_2-~~

A^1, A^2, A^3 are each, independently of one another, phenylene-1,4-diyl, unsubstituted or monosubstituted or disubstituted by CN or F, phenylene-1,3-diyl, unsubstituted or monosubstituted or disubstituted by CN or F, cyclohexane-1,4-diyl, in which one or two H atoms may be replaced by CN and/or CH_3 and/or F, 1-cyclohexene-1,4-diyl, in which one H atom may be replaced by F, 1-alkyl-1-silacyclohexane-1,4-diyl, pyridine-2,5-diyl, unsubstituted or monosubstituted by F, pyrimidine-2,5-

diyl, unsubstituted or monosubstituted by F, cyclopentane-2,5-diyl or thiophene-2,5-diyl;

M^1, M^2 are undirected and are each, independently of one another, -OC(=O)-, $-OCH_2-$, $-CH_2CH_2-$, $-OC(=O)CH_2CH_2-$, $-OCH_2CH_2CH_2-$, -C≡C-, $-CH_2CH_2CH_2CH_2-$ or a single bond;

~~a, b are each, independently of one another, 0 or 1.~~

Claim 2 (previously presented)

2. A liquid-crystal mixture comprising at least one compound of the formula (I) as claimed in claim 1.

Claim 3 (currently amended)

3. A liquid-crystal mixture as claimed in claim 2, which comprises from 0.01 to 80% by weight, based on the entire weight of the mixture, of one or more compounds of the formula (I).

Claim 4 (previously presented)

4. A liquid-crystal mixture as claimed in claim 2, which is ferroelectric (chiral smectic).

Claim 5 (previously presented)

5. A liquid-crystal mixture as claimed in claim 2, which is nematic.

Claim 6 (previously presented)

6. A ferroelectric switching and/or display device, which contains a ferroelectric liquid-crystal mixture as claimed in claim 4.

Claim 7 (previously presented)

7. A ferroelectric switching and/or display device as claimed in claim 6, which contains active matrix elements and wherein the liquid-crystal layer forms a monostable monodomain.

Claims 8-12 (cancelled)

Claim 13 (new)

13. A liquid-crystal mixture as claimed in claim 2, which comprises 0.1 to 30% by weight, based on the entire weight of the mixture, of one or more compounds of formula (I).

Claim 14 (new)

14. The liquid-crystal mixture of claim 13, which is ferroelectric (chiral smectic) and further comprises one or more compounds having a smectic phase.

Claim 15 (new)

15. The liquid-crystal mixture of claim 13, which is nematic and further comprises one or more compounds having a nematic phase.

Claim 16 (new)

16. The ferroelectric switching and/or display device of claim 7, which contains a liquid-crystal mixture comprising at least one compound of the formula (I):

$$R^1\text{-}X\text{-}(A^1\text{-}M^1)_a\text{-}(A^2\text{-}M^2)_b\text{-}A^3\text{-}Y\text{-}E \quad (I)$$

where the symbols and indices have the following meanings:

E is a radical T-Z-R^2 containing a five-membered ring, where:

(i) T is undirected and is
4-fluorothiophene-2,5-diyl, 3-fluorothiophene-2,5-diyl,
3-fluorothiophene-2,4-diyl or 5-fluorothiophene-2,4-diyl

Z is a single bond or -O-

R^2 is hydrogen or a straight-chain or branched alkyl radical (with or without asymmetric carbon atoms) having 1 to 20 carbon atoms, where one nonterminal CH_2 group may be replaced by -O- or -OC(=O)- or -C(=O)O- and/or one or more H atoms may be replaced by F, with the provisos that
a) the -CH_2- group nearest to the thiophene cannot be replaced by -O- when Z is -O-

b) R^2 can only be hydrogen when Z is a single bond,

Y is –OC (=O)- , $-OCH_2-$, $-CH_2CH_2-$

a, b are each, independently of one another, 0 or 1

(ii) T is furan-2,5-diyl or furan-2,4-diyl

Z is a single bond or -O-

R^2 is a straight-chain or branched alkyl radical (with or without asymmetric carbon atoms) having 1 to 20 carbon atoms, where one nonterminal CH_2 group nonadjacent to furan may be replaced by -O- or -OC(=O)- or -C(=O)O- and/or one or more H atoms may be replaced by F,

Y is -OC(=O)- , $-OCH_2-$, $-CH_2CH_2-$

a, b are each, independently of one another, 0 or 1

(iii) T is undirected and is isoxazole-3,5-diyl

Z is a single bond or -O-

R^2 is hydrogen or a straight-chain or branched alkyl radical (with or without asymmetric carbon atoms) having 1 to 20 carbon atoms, where one nonterminal CH_2 group may be replaced by -O- or -OC(=O)- or -C(=O)O- and/or one or more H atoms may be replaced by F, with the provisos that a) the $-CH_2-$ group nearest to the isoxazole cannot be replaced by -O- when Z is -O-

b) R^2 can only be hydrogen when Z is a single bond,

a is 1

b is 0 or 1

Y is -OC(=O)- , $-OCH_2-$, $-CH_2CH_2-$

(iv) T is undirected and is thiazole-2,5-diyl or thiazole-2,4-diyl

Z is a single bond

R^2 is hydrogen or a straight-chain or branched alkyl radical (with or without asymmetric carbon atoms) having 1 to 20 carbon atoms, where one nonterminal CH_2 group may be replaced by -O- or -OC(=O)- or -C(=O)O- and/or one or more H atoms may be replaced by F,

Y is $-OC(=O)-$, $-OCH_2-$, $-CH_2CH_2-$

a, b are each, independently of one another, 0 or 1

(v) T is cyclopentane-1,3-diyl, in which one $-CH_2CH_2-$ or $-CH_2CH-$ group is replaced by a -CH=CH- or. CH=C- group respectively

Z is a single bond

R^2 is hydrogen or a straight-chain or branched alkyl radical (with or without asymmetric carbon atoms) having 1 to 20 carbon atoms, where one nonterminal CH_2 group may be replaced by -O- or -OC(=O)- or -C(=O)O- and/or one or more H atoms may be replaced by F, with the proviso that the $-CH_2-$ group nearest to the cyclopentene cannot be replaced and where

Y cannot be $-CH_2-CH_2-$,

a is 1

b is 0 or 1

Y is $-OC(=O)-$, $-OCH_2-$

R^1 is hydrogen or a straight-chain or branched C_{1-20}-alkyl or C_{2-20}-alkenyl radical (with or without asymmetric carbon atoms), where

a) one or two nonterminal CH_2 groups may be replaced, independently of one another, by -O- or -C(=O)-, with the proviso that two adjacent CH_2 groups cannot be replaced in the same way, and/or

b) one CH_2 group may be replaced by -C≡C-, and/or

c) one CH_2 group may be replaced by $-Si(CH_3)_2-$, cyclopropane-1,2-diyl, cyclobutane-1,3-diyl, cyclopentane-1,4-diyl, bicyclo[1.1.1]pentane-1,3-diyl or cyclohexane-1,4-diyl, and/or

d) one or more H atoms may be replaced by F and/or CN,

e) in the case of a branched alkyl radical containing asymmetric carbon atoms, the asymmetric carbon atoms have $-CH_3$, $-OCH_3$, $-CF_3$, F, CN and/or Cl as substituents or are incorporated into a 3- to 7-membered ring, in which, in addition, one or two non-adjacent CH_2 groups may be replaced by -O- and one CH_2 group non-adjacent to these groups may be replaced by -OC(=O)-;

X is a single bond, -O-, OC(=O)-, -C(=O)O- or -OC(=O)O-

A^1, A^2, A^3 are each, independently of one another, phenylene-1,4-diyl, unsubstituted or monosubstituted or disubstituted by CN or F, phenylene-1,3-diyl, unsubstituted or monosubstituted or disubstituted by CN or F, cyclohexane-1,4-diyl, in which one or two H atoms may be replaced by CN and/or CH_3 and/or F, 1-cyclohexene-1,4-diyl, in which one H atom may be replaced by F, 1-alkyl-1-silacyclohexane-1,4-diyl, pyridine-2,5-diyl, unsubstituted or monosubstituted by F, pyrimidine-2,5-diyl, unsubstituted or monosubstituted by F, cyclopentane-2,5-diyl or thiophene-2,5-diyl;

M^1, M^2 are undirected and are each, independently of one another, -OC(=O)-, $-OCH_2-$, $-CH_2CH_2-$, $-OC(=O)CH_2CH_2-$, $-OCH_2CH_2CH_2-$, $-C\equiv C-$, $-CH_2CH_2CH_2CH_2-$ or a single bond;

wherein said liquid crystal mixture is ferroelectric (chiral smectic) and further comprises one or more compounds having a smectic phase.

Claim 17 (new)

17. The ferroelectric switching and/or display device of claim 7, which contains a liquid-crystal mixture comprising at least one compound of the formula (I):

$$R^1\text{-}X\text{-}(A^1\text{-}M^1)_a\text{-}(A^2\text{-}M^2)_b\text{-}A^3\text{-}Y\text{-}E \qquad (I)$$

where the symbols and indices have the following meanings:

E is a radical T-Z-R^2 containing a five-membered ring, where:

(i) **T** is undirected and is
4-fluorothiophene-2,5-diyl, 3-fluorothiophene-2,5-diyl,
3-fluorothiophene-2,4-diyl or 5-fluorothiophene-2,4-diyl

Z is a single bond or -O-

R^2 is hydrogen or a straight-chain or branched alkyl radical (with or without asymmetric carbon atoms) having 1 to 20 carbon atoms, where one nonterminal CH_2 group may be replaced by -O- or -OC(=O)- or -C(=O)O- and/or one or more H atoms may be replaced by F, with the provisos that
a) the -CH_2- group nearest to the thiophene cannot be replaced by -O- when Z is -O-
b) R^2 can only be hydrogen when Z is a single bond,

Y is –OC (=O)- , -OCH_2-, -CH_2CH_2-

a, b are each, independently of one another, 0 or 1

(ii) **T** is furan-2,5-diyl or furan-2,4-diyl

Z is a single bond or -O-

R^2 is a straight-chain or branched alkyl radical (with or without asymmetric carbon atoms) having 1 to 20 carbon atoms, where one nonterminal CH_2 group nonadjacent to furan may be replaced by -O- or -OC(=O)- or -C(=O)O- and/or one or more H atoms may be replaced by F,

Y is -OC(=O)- , -OCH_2-, -CH_2CH_2-

a, b are each, independently of one another, 0 or 1

(iii) **T** is undirected and is isoxazole-3,5-diyl

Z is a single bond or -O-

R^2 is hydrogen or a straight-chain or branched alkyl radical (with or without asymmetric carbon atoms) having 1 to 20 carbon atoms, where one

nonterminal CH_2 group may be replaced by -O- or -OC(=O)- or -C(=O)O- and/or one or more H atoms may be replaced by F, with the provisos that

a) the $-CH_2-$ group nearest to the isoxazole cannot be replaced by -O- when Z is -O-

b) R^2 can only be hydrogen when Z is a single bond,

a is 1

b is 0 or 1

Y is $-OC(=O)-$, $-OCH_2-$, $-CH_2CH_2-$

(iv) **T** is undirected and is thiazole-2,5-diyl or thiazole-2,4-diyl

Z is a single bond

R^2 is hydrogen or a straight-chain or branched alkyl radical (with or without asymmetric carbon atoms) having 1 to 20 carbon atoms, where one nonterminal CH_2 group may be replaced by -O- or -OC(=O)- or -C(=O)O- and/or one or more H atoms may be replaced by F,

Y is $-OC(=O)-$, $-OCH_2-$, $-CH_2CH_2-$

a, b are each, independently of one another, 0 or 1

(v) **T** is cyclopentane-1,3-diyl, in which one $-CH_2CH_2-$ or $-CH_2CH-$ group is replaced by a -CH=CH- or. CH=C- group respectively

Z is a single bond

R^2 is hydrogen or a straight-chain or branched alkyl radical (with or without asymmetric carbon atoms) having 1 to 20 carbon atoms, where one nonterminal CH_2 group may be replaced by -O- or -OC(=O)- or -C(=O)O- and/or one or more H atoms may be replaced by F, with the proviso that the $-CH_2-$ group nearest to the cyclopentene cannot be replaced and where

Y cannot be $-CH_2-CH_2-$,

a is 1

b is 0 or 1

Y is -OC(=O)- , -OCH_2-

R^1 is hydrogen or a straight-chain or branched C_{1-20}-alkyl or C_{2-20}-alkenyl radical (with or without asymmetric carbon atoms), where

a) one or two nonterminal CH_2 groups may be replaced, independently of one another, by -O- or -C(=O)-, with the proviso that two adjacent CH_2 groups cannot be replaced in the same way, and/or

b) one CH_2 group may be replaced by -C≡C-, and/or

c) one CH_2 group may be replaced by -$Si(CH_3)_2$-, cyclopropane-1,2-diyl, cyclobutane-1,3-diyl, cyclopentane-1,4-diyl, bicyclo[1.1.1]pentane-1,3-diyl or cyclohexane-1,4-diyl, and/or

d) one or more H atoms may be replaced by F and/or CN,

e) in the case of a branched alkyl radical containing asymmetric carbon atoms, the asymmetric carbon atoms have -CH_3, -OCH_3, -CF_3, F, CN and/or Cl as substituents or are incorporated into a 3- to 7-membered ring, in which, in addition, one or two non-adjacent CH_2 groups may be replaced by -O- and one CH_2 group non-adjacent to these groups may be replaced by -OC(=O)-;

X is a single bond, -O-, OC(=O)-, -C(=O)O- or -OC(=O)O-

A^1, A^2, A^3 are each, independently of one another, phenylene-1,4-diyl, unsubstituted or monosubstituted or disubstituted by CN or F, phenylene-1,3-diyl, unsubstituted or monosubstituted or disubstituted by CN or F, cyclohexane-1,4-diyl, in which one or two H atoms may be replaced by CN and/or CH_3 and/or F, 1-cyclohexene-1,4-diyl, in which one H atom may be replaced by F, 1-alkyl-1-silacyclohexane-1,4-diyl, pyridine-2,5-diyl, unsubstituted or monosubstituted by F, pyrimidine-2,5-diyl, unsubstituted or monosubstituted by F, cyclopentane-2,5-diyl or thiophene-2,5-diyl;

M^1, M^2 are undirected and are each, independently of one another, -OC(=O)-, $-OCH_2-$, $-CH_2CH_2-$, $-OC(=O)CH_2CH_2-$, $-OCH_2CH_2CH_2-$, -C≡C-, $-CH_2CH_2CH_2CH_2-$ or a single bond;

wherein said liquid crystal mixture is nematic and further comprises one or more compounds having a nematic phase.